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Variability of Wetland Reflectance and Its Effect On Automatic Categorization of Satellite Imagery

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Significant Results

A technique for training automated analysis of satellite (LANDSAT) multispectral data based on *in situ* measurements of target reflectance was tested and applied in delineating cover communities in Delaware's tidal wetlands. The technique evaluated uses ground measured reflectance and an atmospheric correction procedure to derive spectral signatures for land-cover categories in preference to the relative radiance signatures traditionally derived from training samples within the satellite data itself.

Land cover categorization of data from the same overpass in four test wetland areas was carried out using a four-category classification system. The tests indicate that training data based on *in situ* reflectance measurements and atmospheric correction of LANDSAT data can produce comparable accuracy of categorization to that achieved using more conventional relative radiance training. The analysis of the four wetlands cover categories (Salt Marsh Cordgrass, Salt Hay, Water and Unvegetated Tidal Flat) produced average categorization accuracies of 82.1% by conventional relative radiance training and 81.4% by use of *in situ* reflectance measurements. Further refinement of the atmospheric correction and ground measurement procedures should produce better accuracies in a more operational mode.

In addition, the field studies showed that variability in spectral reflectance was, as expected, symptomatic of significant physical characteristics of the test cover types such as time elapsed since tidal inundation of mud, plant height and growth form. Significant correlations were found between single band and ratioed reflectances and tidal inundation and plant height characteristics. The techniques developed and tested are applicable to any airborne or orbital scanner and to inventory of any terrestrial or aquatic feature discernable by multispectral means.

The selective use of atmospherically corrected data and reflectance signatures measured in situ would allow significant improvement over editing of "training sets" from scanner data in several ways:

a) While ground truth is still required it is not necessary to locate the geographic coordinates of sample areas nor must the information be updated frequently. Ground measurements over a particular cover type will be representative of that type even if changes subsequently occur in the sample area.

b) Training data may be collected over areas too small to provide a statistically adequate "training set" extracted from the satellite data, allowing detection and monitoring of smaller features than is possible using "training sets" composed of 20-50 pixels. Further, an investigator on the ground can be much more effective in recording the conditions present in the specific site he has sampled. Such sampling accompanied by measurements of factors other than reflectance allow significant relationships between reflectance and other characteristics to be observed as an integral part of "ground truth" collection.

c) Radiance measurements transformed to "absolute reflectance" through applicaton of atmospheric corrections may be manipulated and extended independent of the solar and atmospheric conditions present during satellite overpasses. Appropriate training data may be applied to analysis of any data for which atmospheric correction has been applied. In detection of change over time such extension of signatures is critical.